HIOU4
H4AR
12.5.1
12/12/11

EW Final Draft STER

Kathy Ketteridge to: Ravi Sanga 12/12/2011 05:15 PM

Cc: Dan Berlin, Doug Hotchkiss, Jeff Stern, Pete Rude, Tom Wang, Bruce Nairn, Kirk Ziegler, Todd DeMunda, Debra Williston - Work

History: This message has been forwarded.

[attachment "EWG Responses to EPA and NOAA STER Comments_12-12-11.pdf" deleted by Ravi Sanga/R10/USEPA/US]
[attachment "EW Revised Final STER_12-12-11.pdf" deleted by Ravi Sanga/R10/USEPA/US]
Hi Ravi,

Attached is the text (redline PDF) and comment responses document for the EW Final Draft STER.

The accompanying figures and appendices have been uploaded to the EW Project website under "Draft Documents." Instructions for accessing the website are below:

Go to: www.eastwaterwaygroup.com

There are two sets of login information required:
website login: EastWW | EwGr0up!
EPA login: EWWUser | EastWW

Let me know if you have problems downloading the figures and appendices.

Thanks and Regards!
Kathy

Kathy Ketteridge, Ph.D., P.E.

Anchor QEA, LLC
1605 Cornwall Avenue
Bellingham, WA 98225
Tel: 360-733-4311 x232
Cel: (b) (6)
email: kketteridge@anchorqea.com
www.anchorqea.com

US Environmental Protection Agency Comments
East Waterway Sediment Transport Evaluation Report, East Waterway Operable Unit, Harbor Island Superfund Site, July 29, 2011

Additional Comments from NOAA provided to EWG by EPA on October 17, 2011

EWG General Response: *EPA and a subset of the EWG discussed these comments during a conference call on October 7, 2011. Attendees for that call included Ravi Sanga (USEPA), Craig Martin (USACE), Joe Gailani (USACE), Bruce Nairn (King County), Tom Wang (Anchor QEA), Kathy Ketteridge (Anchor QEA), Vladimir Shepsis (CHE), and Dave Simpson (CHE).*

The responses to comments provided below reflect the conclusions of that conversation. EPA also provided additional comments from NOAA that EWG has addressed at the end of this document.

General Comment:

A. More information is needed to justify the assumption of 2 Pa as the maximum shear stress experienced at some of the docking locations and the navigation channel in East Waterway. Two (2) Pa for short bursts should not induce excessive erosion with depth. EPA fully understands that available geochronology data indicate that some of these areas are depositional. However, geochronological core data are sparse and insufficient to indicate whether these areas have experienced historic scaring or local mixing from props. The size of ships that can (but, possibly do not presently) use some of these areas must also be discussed. When any large vessel, and its associated tugs, maneuver there is always a potential of a larger shear stress and associated scour due to extreme handling events and this must be more clearly discussed in the text.

   EWG Response: *Based on discussion with EPA, we will update the text to provide additional detail regarding predicted shear stresses within the navigation channel in the EW. The estimated value of 2 Pa is representative of typical transiting maneuvers in the navigation channel; however, the navigation channel can expect to experience a range of shear stresses due to adjacent berthing maneuvers.*

B. In addition, please add more information on how the CSM can be improved and refined for the north, shallow end of the river where 1) velocity is small, 2) prop wash is nominal and 3) the bottom is armored by gravel/there is no evidence of sedimentation. More discussion is needed between EPA and the EWG regarding adding these multiple Lines of Evidence in improving the CSM.

   EWG Response: *Per discussions with EPA during development of the STER, we will clarify in the document text that the CSM will be updated in the SRI Report.*

C. Also, the uncertainty discussion in Section 6.3.1 needs to be more developed; the vessel operation model scenarios have very little supporting data and require significant assumptions about operations. For example, Scenario 7 – Area 2, Slip 36 model simulations were calculated without specific feedback from the USCG (described in Table 5-2, Vessel Operation within each Operational Area in East Waterway).

EWG Response: *The EWG had several discussions with USCG to collect operations and vessel information that was used to develop propwash scenarios within Slip 36 and adjacent areas of the EW. We will clarify these discussions in the text.*

D. Also, the description of uncertainties related to prop wash is incomplete. For example, steady state conditions assume a fully developed boundary layer, which is not a conservative assumption. Please add additional clarity to the uncertainty discussion.

EWG Response: *We will provide additional information in the text summarizing past studies conducted to inform the use of the logarithmic profile for the propwash evaluation. References will be added to the text to clarify this uncertainty. These references include field data/studies that show the fully developed boundary layer assumption was adequate for evaluation of maximum propwash velocities.*

Specific Comments:

1) Section 5.1.1, second paragraph. JETWASH is not on the USACE list of "approved" models. However it does not need to be on the list to be used at the East Waterway. EPA and the EWG will need to discuss an appropriate reference further for the JETWASH model.

EWG Response: *We will clarify in the text that the model has been accepted by EPA for use on the Fox River project and reference it with an appropriate reference based on model development (e.g., published article).*

2) Section 5.1.1, third paragraph. More justification is needed regarding assumptions of a logarithmic profile for flow induced by a prop. The assumption of a logarithmic profile would be appropriate if a developed flow regime existed. However, prop wash is inherently un-developed flow. Therefore, log profile is incorrect. Hence, the assumption is not a "logarithmic velocity profile", rather this profile is being used with the understanding that this is an additional level of uncertainty to the model predictions. More explanation is needed regarding at what height the value of velocity is used in the measurement. This is the value at which a logarithmic profile is assumed (between this value and the bed surface). There is significant difference in the uncertainty of this assumption if the value is at 20 cm vs 2 m, for example. A discussion between EPA and the EWG is needed regarding this issue.

EWG Response: *See Response to General Comment "D." Additional references and language will be added to the text to clarify the height above the bed that the propwash velocities were estimated.*

3) Section 5.4.1, first paragraph. Please confirm that the USCG has provided additional data to determine if these estimates are correct.

EWG Response: *See Response to General Comment "C."*

4) Section 5.1.2, third paragraph. Please discuss uncertainty introduced by not accounting for emergency operations. Unlike large storms, emergency operations are not recorded. Therefore, we cannot monitor in response to emergency operations. Please quantify the recurrence – for example is it very rare (1000 year return period event). Also indicate how EWG plans to monitor for extreme scours as this is of concern.

EWG Response: *Following discussions with EPA, we are in agreement that taking into account extreme conditions is typically a design-level evaluation. Since the purpose of the STER is to assess overall project feasibility, the scenarios included in the STER are adequate for that purpose. Additional evaluation will be conducted during the design phase of the project to address impacts of extreme events on design. Monitoring discussions will be addressed in the FS or design phases of the project.*

5) Section 5.1.2, fourth paragraph. Please note that extremes exist within typical operating conditions (bad weather days) vs extremes with very long return periods (emergency operations).

EWG Response: *See Response to Specific Comment No. 4.*

6) Section 5.1.2, second paragraph. With regards to the following sentence: Tugs transiting the waterway". Please explain if this activity is fast or slow or typical.

EWG Response: (This should reference Section 5.1.3.) *This activity, as referenced in the text, represents safe operation speeds within the EW based on interviews with tug pilots.*

7) Section 5.1.4.1, first paragraph. Please explain if we are assuming that this maximum velocity can occur anywhere within Area 1. A figure is needed to provide additional clarity for this scenario.

EWG Response: *This information will be clarified in the text.*

8) Section 5.1.4.2, first paragraph. "Predicted velocity generated by the ship's..." Please clarify the red portion and yellow portion on figure 5-4 and how these portions are related to the velocity scale. Specifically, can the red shaded area experience velocity of 10+ ft/s

while the yellow area experience velocity of approximately 8 ft/s? If this is correct, then how is this reconciled with Figure 5-19, which seems to show a narrower region (1A) of high shear stress, while the channel only experiences 2 Pa. The region of 2 Pa in Figure 5-19 seems to overlap with the yellow region in Figure 5-4. Please verify that this is correct. Also clarify if the yellow region in Figure 5-4 represents areas with velocity of 8 ft/s. If this is true please explain if this induces higher shear than 2 Pa.

EWG Response: *We discussed this question with EPA and have agreed that clarification in the text regarding the orientation of the referenced figure is adequate to address this comment.*

9) Section 5.2. paragraph 2. "Figure 5-19 provides maximum bed shear..." As stated previously (figure 5-4), there seems to be velocity regions in the middle of the channel that would produce shear stress greater than 3 Pa. Please clarify.

EWG Response: *See Response to Specific Comment No. 8.*

10) Section 5.3.2, paragraph 3. The following sentence needs clarification: "For all cases, the near-bed velocity due to pressure fields (1.3 ft/s) was less than the near-bed velocities predicted due to propwash throughout the EW (3.0 ft/s and greater)" Please explain if the velocity should be added to the prop velocity to provide a maximum velocity induced by ship movement or whether the prop velocity and pressure-field velocity occur at different locations.

EWG Response: *We have completed an additional evaluation to determine if there are situations where these two velocities could be additive. The results of this evaluation show that pressure field velocities are in the direction of vessel motion, while propwash velocities are in the direction opposite vessel motion. Therefore, these velocities are not additive. These results will be incorporated into the STER text and will be discussed with EPA prior to submittal of the final STER.*

11) Section 5.4.3, paragraph 1. Please add information about rare and undocumented scenarios (emergency operations). Their frequency is not definable, but it may be possible to provide some general quantification of magnitude (shear stress) related to these possible events. The text does not attempt to quantify this. This is not acceptable, please add the appropriate text or documentation of extreme events at other sites to describe what this scour may look like in EWW. More documentation needs to be added regarding extreme events at other sites to describe what this scour may look like on the LDW. Extreme events have very high shear stress – so the EW-specific critical stress value is irrelevant and we can use other sites as examples of what might happen on the LDW.

EWG Response: *See Response to Specific Comment No. 4.*

12) Section 5.4.3, paragraph 3. With regards to the Fox River, the decision to accept the results was due to multiple factors; "accepting" model results as valid was only secondary. In addition, the Fox River was for recreational boat prop wash, which is quite different from container ship navigation. It is not appropriate to use the Fox River to demonstrate model validity at the EWW, please remove this language.

EWG Response: S*ee Response to Specific Comment No. 1.*

13) Section 6, table 6-3. Linear and log-linear regression must be checked against lowest shear stress where zero erosion value is measured. Critical shear stress cannot be lower than the lowest Sedflume measured value no matter what the regression shows. Critical value also cannot be higher than the lowest shear stress for which erosion occurred. This should have been checked when developing tables 6-2 and 6-3 and needs to be checked now. Comparing to measurements may eliminate some of the discrepancy for SF_04 and SF_07 critical values for the various regression methods.

EWG Response: *This comparison was completed and additional description was added to the text. The results will be discussed with EPA prior to submittal of the final STER.*

14) Section 7.3.7. Although not an uncertainty, it must be noted in this section that resuspension and redeposition by ship traffic is not included in these scenarios.

EWG Response: *Clarification will be added to the text.*

15) Section 8.2, paragraph 2. The following sentence requires further explanation:

"This observation is not consistent with the results of geochronological core data (Section 3); which imply that areas south of Slip 27 (between EW Stations 4000 and 5200) are not subject to mixing at depth below the mudline." Please expand on this sentence. Please explain how many cores were used to determine that modeling was inconsistent with core data. Also clarify the final conclusion that prop-induced erosion is possible, but not probable in these areas. Please add information on how confident we are that contaminated sediment will not re-suspend in these areas.

EWG Response: *Clarification will be added to the text regarding consistency between geochronology core data and areas south of Slip 27. As discussed with EPA, geochronology data and modeling results may be considered consistent within this area. The referenced area may be net depositional over time (as shown by the geochronology core data), but be subject to occasional resuspension events due to propwash/vessel*

activity in those areas. As agreed during discussions with EPA, no additional information regarding resuspension potential will be provided in the text.

Additional comments from NOAA; provided to EWG by EPA on October 17, 2011:

1) Section 2.2, page 10. Please state that the LDW hydro model included high flow events, although validation data were sparse for higher flows. Also state that LDW model results indicated that high fresh water inflow had little influence on the near-bed velocities in the lower several miles of the river, including the EW and that the near-bed velocities in the lower miles are still dominated by salt water wedge motion. Please also state that the greater body of data on modeling of stratified estuaries indicates that the hydrodynamic model used for the LDW is robust and will accurately represent high-flow conditions and that a wide range of sensitivity tests were performed on the LDW hydro model. No simulations within the feasible range indicated high near-bed velocity in the EW. LDW field data indicate a highly stratified flow regime under all conditions. Data which include this stratification indicate that velocity in the bottom half of the water column for the lower portions of the LDW will be driven by tidal range, not freshwater inflow. It must also be noted that the purpose of the model is to permit the EPA to extrapolate to conditions for which no data exist. Having data at high flow would reduce model uncertainty. It must be noted that the hydro model used for the LDW/EW is robust and well demonstrated under event conditions and that the body of work developed using this model, coupled with this model to replicate the non-event EW-specific data provides confidence that the model application can be extrapolated to high flow conditions.

   EWG Response: *A summary (one to two paragraphs) of the history of the LDW model development and its review by EPA will be provided in the text. A statement will be added to the text that points the reader to references regarding the LDW model development and results.*

2) Figures 3.3A and B must be described in the text. Cores GC-13 and GC-11 look fairly similar in terms of having multiple depths with similar radiometric results. Please explain why it was possible to estimate a peak for 11 but not for 13.

   EWG Response: *A more detailed explanation will be added to the text to explain why a peak was chosen for GC-11 and not GC-13. Based on review of radiochemistry results and core logs from nearby cores (including GC-13 and GC-11), we expect that the cesium-137 peak at GC-11 was below the recovered depth of the core. Therefore, we assigned a minimum net sedimentation rate to GC-11based on the deepest sampled interval in the core.*

3) Section 3.3 page 20. Instead of referring to "the presence of non-discernable peaks" it would make more sense to refer to "the absence of discernable peaks". The former wording implies that peaks are known to be present but could not be seen in this dataset, which is not the case. Please change the language accordingly.

EWG Response: *Wording in the text will be changed as suggested.*

4) Section 3.4, page 21. The uncertainty discussion focuses on uncertainty in the numeric values of the estimated net sedimentation rates, and must also discuss the uncertainty inherent in using net sedimentation rates averaged over long time periods to estimate shorter-term (annual) rates. Please add the appropriate language.

EWG Response: *A brief discussion of the uncertainties associated with using the longer-term net sedimentation rates from geochronology cores to estimate annual average net sedimentation rates will be added to the text.*

5) Section 4.4 page 26. Please add some description in the text of what the term "high signal to noise ratio" means in the standard data analysis context.

EWG Response: *A definition will be added to the text that states that high signal to noise ratios, as measured by ADCPs, generally imply very low current velocities.*

6) Table 4-2. Calibration simulation 6- column 3 states that bottom roughness "varies from 0.05 to 0.5" meters. Please reconcile this with the text on page 26 which says that the bottom roughness height was increased to 20 cm.

EWG Response: *The text will be modified to be consistent with information provided in the table.*

7) Figures 4-7, 4-8, and 4-9 show no measurements deeper than 8 m. Please explain how close this is to the sediment bed. As noted on page 7, step 2, calibration must specifically focus on bottom velocities because those are the most influential in determining erosion. Also, please add text defining the near-bottom depth interval for which no data are collected.

EWG Response: *The current profiles collected as part of the STE were taken with bottom-mounted ADCPs. These instruments sat some distance off the sea bed and were also subject to a "blanking distance" above the instrument—i.e., before viable current data could be measured. (The blanking distance is defined as the distance above the ADCP that viable backscatter measurements can be taken. It is a function of the*

frequency of the instrument, as well as other factors. The blanking distance can also take into account the distance away from the instrument where disturbance effects from circulation around the instrument itself are negligible). Therefore, velocities at the sediment bed were not explicitly measured by the ADCPs. Distance above the bed where current measurements were taken varies slightly by instrument and deployment, but were generally 1 to 1.5 meters above the bed for Sites 3 and 4 (in shallower water) and 2 meters above the bed for Sites 1 and 2 (in deeper water). Calibration of the model was done by comparing actual current data with model results at the appropriate heights above the bed.

Please also note that the velocity profile in this area, where no data is collected, can be reasonably estimated using standard methods of interpolation. Velocity in the bottom bin of the ADCP is low. Therefore, for the EW, the velocity profile will indicate that the bottom shear stress values are below critical for initiation of suspension.

EWG Response: *We agree with this statement.*

8) Section 4.4 page 28, top paragraph, discusses the modeled distribution of flow in EW and WW. Please explain to what extent this was checked against measurements. The authors must add text defining the thought process that was used to accept the EW/WW distribution and state that no data were collected during the LDW study to validate model distribution of flow between EW and WW. Please also mention that in the subsequent EW study, velocity data were collected near the entrance to the EW near the LDW and that these data were used to calibrate/validate the EW model – including water mass entering from the LDW based on the original LDW model. It must also be noted in the text that no robust validation exists to demonstrate LDW model capability to distribute water between East and West Waterways, especially during events. Please emphasize that in the long run, this will not significantly affect resuspension because of EWW stratification.

EWG Response: *We agree that the LDW model did not attempt to verify the split in flow between the EW and WW. As part of the EW STE, data were collected and compared with model results to validate model estimates of the split in flow between the EW and WW. The split in flow was evaluated using ADCP transect data collected as part of the EW STE. (The locations of these transects are shown in Figure 2-1). This is described in the text in Section 4.4 (Page 28, second paragraph) and shown graphically in Figure 4-10. We will clarify in the text that the ADCP transect data are not available in the EW for higher flow events. A discussion of the influence of increasing freshwater flow on bottom velocities (and resuspension) in the EW is provided in Sections 6.2.1.3 and 8.2. This discussion is in agreement with this comment.*

Please state that the model is not used for sedimentation estimates, geochron data are used instead.

EWG Response: *This information is discussed in Section 3.0.*

Please also state it would be beneficial to have a better understanding of flow partitioning – but it is not critical to developing lines of evidence because it has been demonstrated that partitioning will not affect re-suspension in this highly stratified estuary (a model-based LOE) and upstream load sedimentation estimates (another LOE) are not model-based.

EWG Response: *We feel that the ADCP transect data collected during development of the EW model, and subsequent comparison of these data with EW model results, provides an increased level of understanding of flow partitioning in the EW (compared to the LDW model effort). However, we agree with the statement that partitioning of freshwater flow from the LDW into the EW does not have a significant effect on resuspension in the EW due to stratification of the flow.*

Lastly the authors can support using PTM during events through sensitivity runs that cover a wide range of conditions to address model uncertainty.

EWG Response: *Comment acknowledged.*

9) Section 4.5, page 30. Paragraph continued from previous page explains the expected velocity patterns at ebb and flood tides and states that the model performed as expected for ebb tide and for surface and mid-depth layers at flood tide. Please clarify whether the different behavior of the bottom layer was expected and provide a conceptual explanation. Text must be added describing the bottom layer comparison of model to data.

EWG Response: *The velocity patterns predicted by the model in the bottom layer were expected due to anticipated salt wedge behavior in the EW. Conceptual explanations for predicted velocity patterns in the near-bottom layer are provided in Sections 4.5.1 through 4.5.3.*

The EWG must explain that this noise does not permit quantification of velocity, but is a clear indicator of low velocity that will not disturb the bed. Also state that the model also predicts low near-bed velocity, therefore model and data are qualitatively consistent.

EWG Response: *ADCP data were collected near bed (approximately 1.5 meters above the bed at Sites 3 and 4), and those data were used for model calibration. This was due to the use of bottom-mounted, upward-looking ADCP current meters for data collection; not due to large signal to noise ratios near the bed. Comparison of near-bottom current velocity data from the ADCPs (starting at approximately 1.5 meter above the bed) and model results shows good agreement post-calibration (as discussed in Section 4.4 and shown graphically in Figures 4-7 and 4-8). A definition will be added to the text that states that high signal to noise ratios, as measured by ADCPs, generally imply very low current velocities.*